

APPENDIX 1:

CALCULATION PROCEDURES

EQUATION 1: The aggregate compliance of the Participating Airlines with the Existing Fleet Emissions Rate Target (*i.e.*, 2.65 g/bhp-hr) shall be based on the Composite Emission Factor (Composite EF). The Composite EF is as follows:

$$\text{Composite EF (g/hp} \cdot \text{hr)} = \frac{\sum_{i=1}^n [(EF_i) \cdot (Power_i) \cdot (LF_i) \cdot (A_i)]}{\sum_{i=1}^n [(Power_i) \cdot (LF_i) \cdot (A_i)]}$$

Where:

- EF_i = The appropriate Emission Factor (g/hp-hr), which is to be selected from Table 1 attached hereto.
- $Power_i$ = Reported brake-horsepower rating for each GSE_i as described below.
- LF_i = The appropriate load factor for a given category of equipment as summarized in Table 2 attached hereto for each GSE_i .
- A_i = Activity factor (hr/yr) reported for each GSE_i as described below.

The Composite EF shall be determined using the aggregate reported values for all GSE included in Table 4 attached hereto, and their replacements. Each of the data inputs is described more fully below.

Population: The GSE population included in the ATA survey is limited to those non-licensed GSE owned or operated by ATA member companies in 1997, or their replacements, not regulated under SCAQMD Regulation XX – RECLAIM, or included in mobile source reduction programs under SCAQMD Rule 1620, and rated 25 HP or greater. A complete list of these existing GSE is provided in Table 4 attached hereto.

Horsepower: Horsepower is based on manufacturer’s rating, except for electric units and for certain existing units. For electric units, horsepower rating is based on the average reported horsepower for a given category of equipment, as summarized in Table 3 attached hereto. For certain existing GSE, these data were not available, and the average reported value for the appropriate category was applied. These data are summarized in Table 4 attached hereto.

Load Factor: All load factors are assigned based on equipment category in Table 2 attached hereto, including electric equipment.

Activity: Activity is determined by either of the following methods:

1. Two weeks at the beginning and two weeks at the end of the compliance period shall be allowed to collect the actual meter readings (*i.e.*, January 1-January 14). The date of meter reading will be recorded, and if meter readings are collected within the specified timeframe, the actual elapsed time during the compliance period will be presumed to be approximated by the elapsed time on the meter. Where data are missing for an elapsed hour meter, the higher of the following must be applied: the average reported value by category for the Individual Participating Airline, or the average reported value for the Participating Airline's aggregate GSE fleet for the compliance year.
2. Average reported values by category, as summarized in Table 3 attached hereto.

Emission Factors: Emission factors reported in Table 1 attached hereto are corrected for air turbines and on-road equivalents as follows:

Correction for Turbine Air Starts: The emission factor for air starts manufactured by either Garrett or Air Research and included in Table 3 attached hereto are to be reduced by a factor of 3.1. There are a total of 21 such units.

Corrections for On-Road Equivalents: The emission factor for on-road equivalents identified in Table 3 attached hereto are to be reduced by a factor of 4.1.

EQUATION 2: The following formula shall be used to determine an Individual Participating Airline's excess emissions over the Existing Fleet Emissions Rate Target:

$$Excess\ Emissions(tons/yr) = \frac{\sum_{i=1}^n [(EF_i - 2.65) \cdot (Power_i) \cdot (LF_i) \cdot (A_i)]}{907,184\ g/ton}$$

The values and units for all input variables are as described for **EQUATION 1** in this Appendix.

EQUATION 3: The following formula shall be used to determine the number of GSE that the Participating Airlines in aggregate, or an Individual Participating Airline should convert to ZEVs to meet the 30 Percent Existing Fleet ZEV Target:

$$ZEV_{Existing} = [(Total\ Units\ in\ Existing\ Fleet)(\%_{yr}) - (ZEV\ in\ Existing\ Fleet)]^1$$

Where:

$ZEV_{Existing}$ = Number of ZEV upon which liquidated damages will be assessed, rounded to the nearest *whole* number; a negative number is rounded to 0.

Existing Fleet = The number of units in the 1997 inventory (either in aggregate or the Participating Airline) that have either been modified, replaced, or remain unchanged *excluding* Ground Power Units, Air Starts, Cargo Loaders and Cargo Tractors.

$\%_{yr}$ = 24% for the 2007 reporting year
40% for the 2010 reporting year

Note that the exclusion of GSE in these four categories of equipment requires that 24% and 40% of the remaining GSE in the existing fleet will be required to achieve the 18% and 30% Existing Fleet ZEV targets for 2007 and 2010, respectively.

$ZEV\ in\ Existing\ Fleet$ = The number of ZEV in the existing fleet (either in aggregate or for the Participating Airline) as of the end of the compliance year. ZEV in Existing Fleet includes all categories of GSE, including, but not limited to, Ground Power Units, Air Starts, Cargo Loaders, and Cargo Tractors. Partial credit for shall be calculated as follows:

Where an existing gate or cargo/aircraft staging area has been provided with electric power:

$ZEV\ Credit = (\#\ of\ GPU\ in\ 1997 - \#\ of\ GPU\ in\ 2010)$

Where a gate or cargo/aircraft staging area has been provided with pre-conditioned air

$ZEV\ Credit = (\#\ of\ Air\ Conditioner\ Units\ in\ 1997 - \#\ of\ Air\ Conditioner\ Units\ in\ 2010)$

¹ For Alaska Airlines, $ZEV_{Existing} = [(Total\ Units\ in\ Existing\ Fleet)(0.33) - (ZEV\ in\ Existing\ Fleet)]$

Additional ZEV credit shall be provided for use of the following innovative technologies:

Each Fuel Cell Powered Vehicle shall equal 1.0 ZEV, unless processing hydrocarbon-based fuels, in which case credit shall equal 0.5 ZEV

Innovative technology developed over the term of the MOU, subject to the approval of the ARB, shall be provided partial credit towards the ZEV target as mutually agreed to between ARB and the Participating Airline.

In no event may partial credit for ZEVs exceed 10% of the total ZEV in the Existing Fleet.

EQUATION 4: The following formula shall be used to determine the number of New GSE that the Participating Airlines in aggregate, or an Individual Participating Airline should convert to ZEVs to meet the New GSE ZEV Target:

$$ZEV_{Growth} = [(Growth\ Fleet)(\%_{yr}) - (ZEV\ in\ Growth\ Fleet)]$$

Where:

ZEV_{Growth} = Number of ZEV upon which liquidated damages will be assessed, rounded to the nearest whole number; a negative number is rounded to 0.

$Growth\ Fleet$ = The number of GSE purchased or transferred to Participating Airports after December 31, 2003 that do not replace an existing unit. The Growth Fleet will not include four categories of GSE, namely cargo loaders, cargo tractors, ground power units, and air starts.

$\%_{yr}$ = 28% in 2007
45% in 2010

$ZEV\ in\ Growth\ Fleet$ = The number of ZEV in the Growth Fleet as of the end of the reporting year. ZEV in Growth Fleet includes all categories of GSE, *including*, but not limited to, Ground Power Units, Air Starts, Cargo Loaders, and Cargo Tractors. Partial credit for fuel cell powered GSE and other innovative technologies shall be calculated as follows:

Each Fuel Cell Powered Vehicle shall equal 1.0 ZEV, unless processing hydrocarbon-based fuels, in which case credit shall equal 0.5 ZEV

Innovative technology developed over the term of the MOU, subject to the approval of the ARB, shall be provided partial credit towards the ZEV target as mutually agreed to between ARB and the Participating Airline.

In no event may partial credit for ZEVs exceed 10% of the total ZEV in the Growth Fleet.

TABLES:

- Table 1:* *Emission Factors* contains **HC+NO_x** emission factors for all existing and new engines, and engines equipped with retrofit kits. This table will be periodically updated by ATA.
- Table 2:* *Load Values* contains the load factors, by category, used in the emission calculations for Equations 1 and 2.
- Table 3:* *Default Values* contains the default values, by category, for Activity and Horsepower.
- Table 4:* *Existing Fleet Inventory, Including Replacements* contains a listing of all equipment in the 1997 Existing Fleet, which is to be updated and maintained under the South Coast GSE MOU Recordkeeping Instructions (Appendix 2).
- Table 5:* *List of Contacts* provides the list of contacts at each Participating Airline.